Global Air Navigation System
~Elements~

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Workshop on the Development of
National Performance Framework to achieve a
Global ATM System
(Mexico City, 6-10 July 2009)
Presentation outline

- Strategic vision of ATM community
- Air navigation system limitations
- Need for change
- Development of concept – FANS to CNS/ATM to Global ATM
- Air Navigation system infrastructure – ATM, CNS, AIM, AGA and MET
To foster the implementation of an interoperable global air traffic management system for all users during all phases of flight that:

- meets agreed levels of safety
- provides for optimum economic operations
- is environmentally sustainable
- meets national security requirements
AREA OF RESPONSIBILITY OF A STATE

Adjacent airspace

Transfer of control (acceptance rate of adjacent airspace)

Overflying aircraft

En-route traffic
No. of IFR flights

Descent phase
Flights/hour

Arrival phase
No. of IFR flights

Landings
Flights/hour

Climb phase
Flights/hour

Departure phase
No. of IFR flights

Departures
Flights/hour

Airport

Runway capacity: Flights/hour

Capacity assessment for ATM
Phases of flight

Gate to Gate Operation

- Pre-departure
- Surface movement
- Climb
- En-route
- Descent
- Surface movement
- Post-arrival
- Taxi start-up
- Take-off
- Departure
- Approach
- Cruise
- Landing
- Taxi termination

Airport management
Air Navigation System
Limitations

- Line-of-sight propagation of ground based CNS facilities
- Difficulty in the implementation of ground based CNS facilities in large parts of the world
- Lack of Digital Air Ground Data interchange Systems
Projected Growth in Air Traffic Demand

Average Annual Increases in Traffic Movements
1992 – 2010
Need for change

- Increased growth in air traffic
- Limitations of ground based CNS systems
- New technologies provide solutions
- Requirement for global consistency

- FANS (Future Air Navigation Systems)
  Committee was established to address the above issues
CNS/ATM System concept development – Background

- ICAO Assembly endorses FANS concept: Sept. 92

- ICAO CNS/ATM systems implementation task force addressed funding, cost recovery & promotion of the concept: Dec. 94
CNS/ATM distinct features …

a) have a mix of satellite and ground-based systems

b) provides global coverage

c) uses interoperable systems
CNS/ATM distinct features

d) provides seamlessness

e) employs air/ground data link

f) employs digital technologies

g) comprises various levels of automation
What is Global ATM system?

Global ATM system can be understood as a worldwide system which:

- facilitates interoperability of different technologies,
- accommodates different procedures, and
- provides harmonization leading to seamlessness across regions.

This is achieved through progressive, cost effective and cooperative implementation of air navigation systems worldwide.
Global ATM system
- Architecture

Air Navigation system architecture to Support ATM Operational Concept:

- ATM
- CNS
- AIM
- AGA
- MET
Air Traffic Management
by
Victor Hernandez,
Regional Officer ATM
Air Traffic Management
~ Definition (March 2007)~

Air traffic management is the dynamic, integrated management of air traffic and airspace (including ASM, ATS and ATFM)—safely, economically, and efficiently—through the provision of facilities and seamless services in collaboration with all parties and involving airborne and ground based functions.
ATM - Elements

AIR TRAFFIC MANAGEMENT

Airspace Organization & management

Air Traffic Services

Air Traffic Flow Management
Airspace organization and management

- Airspace organization
  - ATS route structure
    - fixed routes
    - PBN routes

- Airspace management
  - fixed and flexible use of airspace
  - civil/military coordination
  - optimized sectorization
Air traffic services ...

- **Air Traffic Control**: Conflict management
  - flight information
  - area control
  - approach control
  - aerodrome control
  - surface movement control

- **Search and Rescue**
  - Emergency locator transmitter (ELT) of COSPAS and SARSAT (406 MHz from 1 Feb 2009) and no satellite coverage for 121.5 MHz

(1/3)
Air traffic services …

- Decision support systems
  - conformance monitoring; MTCA/STCA; MSAW
  - PRM for independent IFR approaches to closely spaced runways
  - arrival metering and sequencing system
  - AIDC

- Separation standards
  - Reduced Horizontal Separation Minimum (RHSM) and Reduced Vertical Separation Minimum (RVSM)
Air traffic services

- Applications
  - data link
  - use of curved and segmented approaches
  - A-SMGCS
Air traffic flow management (ATFM) …

- **ATFM Objective**
  - to ensure an optimum flow of air traffic through areas during times when demand exceeds or is expected to exceed the available ATC capacity
  - Demand and capacity balancing
  - Traffic synchronization

- **Application of ATFM**
  - re-routing; and
  - allocation of slots
ATFM …
～ Phases of ATFM activity～

- **Strategic phase**: Strategic activities are research, planning and coordination activities carried out in the period from two days to several months in advance of the day of operation.

- **Pre-tactical phase**: Pre-tactical activities are planning and coordination activities carried out within the two days prior to the day of operation.

- **Tactical phase**: Tactical activities are ATFM activities carried out on the day of operation.

- **Airborne flights**: ATFM shall take action on individual flights before their departure and shall not normally intervene in the progress of airborne flights which are the responsibility of the appropriate ATC unit. However, airborne flights may be subject to additional tactical ATFM measures.
Communications/Navigation/ Surveillance
(will be covered in a separate presentation)
IM Central component of ATM System

IM / SDM = Information Management / ATM Service Delivery Management
Aeronautical Information Management

~ Definition (Dec. 2008)~

Aeronautical Information Management is the dynamic, integrated management of aeronautical information services — safely, economically, and efficiently — through the provision and exchange of quality assured digital aeronautical data in collaboration with all parties.
AIM - Elements

- **Phase 1 : Consolidation**, mainly quality requirements; AIRAC adherence; WGS-84; and the provision of terrain and obstacle data.

- **Phase 2 : Going digital**, introduction of database-driven processes (eAIP, AIXM); enhance the quality and availability of existing products.

- **Phase 3 : Information Management**, new products and services; provision of the new data that will be required by the future ATM components.
Transition to AIM

- **2009, AIS-AIMSG** first meeting 2-4 Dec. 2008, see [http://www.icao.int/anb/aim](http://www.icao.int/anb/aim),
  - Preliminary review of Amendment 36 Annex 15 & Amendment 56 Annex 4;
  - Amendment 2 Doc 8126 (AIS Manual);
  - Amendment 30 PANS-ABC.

- **2010, Going digital**
  - Start developing Amendment 37 Annex 15 & Amendment 57 Annex 4;
  - Recommendations and guidance on data exchange, no obligations.
  - eAIP, AIXM, Training, Quality Guidance Material
Transition to AIM

- **2013, Information Management**
  - Amendment 37 Annex 15 & Amendment 57 Annex 4 become applicable.
  - Possible **Divisional Meeting** to agree on new requirements for data exchange.

- **2016, Transition achieved**
  - Amendment 38 Annex 15 & Amendment 58 Annex 4 would become applicable including recommendation of divisional meeting;
Aerodrome Operations
by
Jaime Calderon,
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AGA - Elements

- aerodrome certification
- new visual aids for prevention of runway incursions
- visual aids for denoting wind turbines
- advanced VDGS to improve apron safety
- enhanced rescue and fire fight provisions
- wildlife strike hazard reduction
- heliports
As of 27 Nov 2003, States shall certify aerodromes used for international operations in accordance with the specifications contained in Annex 14, Vol I,
Future Works (by 2012)

- New runway safety provisions on:
  - runway end safety area (RESA)
  - visual aids to prevent runway incursions
  - surface friction measurement and reporting

- Enhanced provision on Aerodrome Emergency Plan (AEP) and Rescue and fire fighting (RFF)

- New efficiency provisions on use of light emitting diodes (LED) technology for visual aids
Meteorology
By
Enrique Camarillo,
Regional Officer MET
MET in support of safety and efficiency - methods

- enhanced accuracy & timeliness of OPMET info
  - Where: en-route, in terminal area & at aerodromes
  - When: during flight planning & in-flight

- consolidation of certain services to a limited number of regional/global MET centres
MET in support of safety and efficiency – impact

- Optimization of flight trajectory
  - Avoiding hazardous weather and volcanic ash
  - Preventing unnecessary closure of airspace (min. safe re-routing of aircraft)
  - Minimizing the environmental impact
- Optimum use of available airport capacity
- Increased cost effectiveness
MET elements (1/2)

- **WAFS**: world area forecast system
  - 2 world area forecast centres
- **IAVW**: international airways volcano watch
  - 9 volcanic ash advisory centres
- **ITCW**: international tropical cyclone watch
  - 7 tropical cyclone advisory centres

Above elements in line with CNS/ATM features

1. Global coverage
2. Seamless
3. Using digital technologies
4. Mix of satellite and ground-based systems
MET elements (2/2)

- MET Watch
  - Some 200 MET watch offices
- Aerodrome MET service
  (including terminal area)
  - 100’s of meteorological offices
    (MET Offices)
Changes in 2010 (1/2)

- **WAFS**
  - Gridded forecasts for CB, icing & turbulence (will eventually replace SIGWX forecasts)
  - Enhanced temporal & spatial resolutions

- **IAVW**
  - Enhancements to accuracy & timeliness of info related to volcanic ash
Changes in 2010 (2/2)

- **Air-reporting**
  - Elimination of voice routine reports (in view of ~ 200,000 automated daily reports)
- **QMS (in support of SMS)**
  - Mandatory concerning all MET elements
- **Aerodrome MET service**
  - Fully automated local MET reports
Future developments (beyond 2010)

- Aerodrome MET service
  - Migration from alpha-numerical codes to XML
  - Enhancement of MET support to ATM
    - To be based on evolving ATM requirements
    - Expected to evolve beyond aerodrome/terminal area
- MET watch
  - Consolidation of the issuance of SIGMET to regional centres corresponding to functional airspace blocks